California High-Speed Train Project

TECHNICAL MEMORANDUM

Aesthetic Guidelines for Non-Station Structures
TM 200.06

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ABSTRACT

This memorandum provides a preliminary system-wide description of aesthetic standards for California High-Speed Train Project (CHSTP) non-station structures, including:

- HST Aerial Structures
- HST Bridges and Overpasses
- Tunnel Portals
- Retaining Walls
- Sound Barriers (or “Walls”)

Many of the visual design principles established for CHSTP stations apply to other essential structures. Designers shall consider the visual quality of structures concurrent with technical and functional quality. Station aesthetics are addressed in a separate document.

HST aerial structure aesthetics address site influences, horizontal and vertical components, detailing and integration of systems elements. Key aesthetic concerns for HST bridges and overpasses include proportion and context, site factors, structural conditions and design approach as either a functional or iconic aesthetic solution. HST bridges and overpasses addressed include railway and pedestrian types.

Other structures requiring aesthetic attention from the outset of design include tunnel portals and retaining walls. Both are addressed in this document.

1.0 INTRODUCTION

This document provides aesthetic guidance for the planning, design, detailing, material selection and construction of structural elements including HST aerial structures, HST bridges and overpasses, tunnel portals and retaining walls. Design of these elements will require collaboration between planners, engineers, architects and community stakeholders in order to ensure consistently high aesthetic standards for structures.

Aesthetics is a discipline concerned with the visual quality of the objects which we view. It studies the ways in which people see and perceive the world around us, particularly with regard to the creation and appreciation of beauty. It is not an objective science; judgments of aesthetic value are relative and dependent upon "the eye of the beholder"; his or her sense of "taste". Still, when a building or structure is viewed, it can display a character which is generally classifiable on a subjective scale of aesthetic quality, from low to high.

1.1 PURPOSE OF TECHNICAL MEMORANDUM

It is the intent of this document to establish principles which will guide designers toward an appropriate level of aesthetic quality while satisfying the Project's functional and budgetary requirements. HST bridge and overpasses, HST aerial structures and other structural elements are not merely utilitarian building components; their aesthetic quality must be considered early in design. Aesthetic character should be integral to the concept and detailing of structures and should not be an afterthought.

The settings into which HST structures will be introduced will be widely diverse, from high-density urban environments to unpopulated, rural places. Structural aesthetics therefore must be responsive to these settings with concern for human scale, building scale (present and future), and the vantage points from which the structures will be viewed.

These guidelines are not intended to prescribe a particular design approach for structural elements. Rather, the guidelines herein allow for contextual design responses to site-specific or unique conditions ("context-sensitive solutions") while ensuring the design objectives are satisfied.

1.2 STATEMENT OF TECHNICAL ISSUE

The following aesthetic principles apply to CHSTP structures:

1. The design principles for stations will be the foundation for aesthetic quality of non-station structures. These include:
   - **Design Excellence.** Pursue the highest visual quality.
   - **Sustainability.** Prioritize energy savings and environmental friendliness.
   - **Art Integration.** Take opportunities to integrate artistic expression into structure.
   - **Cost Effectiveness.** Use performance standards and life-cycle costing to deliver value.
   - **Contribution to Communities.** Enhance local environments and community context.
   - **Preservation of Historic Structures of Value.** Preserve structures of lasting value.
2. Structures should be conceived, designed, detailed and constructed with an emphasis on aesthetic character and visual harmony with the surrounding environment while satisfying primary functional and engineering requirements.
3. Civil works, systems elements, and station design should be coordinated to ensure aesthetic consistency and continuity.
4. Aesthetic character should be an integral element of structural design, rendering surface treatments unnecessary. Finishes should only be necessary where structural material requires protection, i.e., steel structures. Where steel is selected as the primary structural material, coating colors should harmonize with adjacent structures and with the immediate setting.
5. Exposed pipes, ducts, cables, etc. should be minimized. Where these elements are unavoidable, they should be concealed in recesses or with coordinated covers.

6. Communities will coexist with CHSTP structures for generations and therefore should be partners in conceiving appropriate aesthetic character for these structures. As with stations, stakeholders shall be engaged early in the design process to establish an aesthetic vision for design of structures, including articulation of purpose, image, context and presence.

1.3 General Information

1.3.1 Definition of Terms

Acronyms/Abbreviations

Authority	California High-Speed Rail Authority
CEQA	California Environmental Quality Act
CHSTP	California High-Speed Train Project
CPTED	Crime Prevention through Environmental Design
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
HSR	High-Speed Rail
HST	High-Speed Train
MSE	Mechanically Stabilized Earth
OCS	Overhead Contact System
PMT	Program Management Team
ROW	Right of Way
TM	Technical Memorandum

2.0 DEFINITION OF TECHNICAL TOPIC

2.1 General

2.1.1 CHSTP Design Considerations

This document provides aesthetic guidance for the planning, design, detailing, material selection and construction of structural elements including HST aerial structures, HST bridges and overpasses, tunnel portals and retaining walls. Design of these elements will require collaboration between planners, engineers, architects and community stakeholders in order to ensure consistently high aesthetic standards for structures.

2.1.2 Roles and Responsibilities

Although the primary purpose of this document is to establish principles to guide visual design decisions for CHSTP structural elements regardless of location, this document also establishes state-wide roles and responsibilities to enable collaborative aesthetic decisions, guide project delivery, and establish public outreach to communities throughout the entire HSR system.

2.2 Laws and Codes

None Applicable

3.0 ASSESSMENT AND INVESTIGATION REQUIREMENTS

3.1 HST AERIAL STRUCTURES

3.1.1 General

Introduction

HST aerial structures will be perhaps the most frequently viewed of all CHSTP structures, occurring throughout the high-speed train system. It is important that these long, continuous structures harmonize visually with local environments and adjacent infrastructure. Viewed from a distance, continuous HST aerial structures may be a dominant feature upon the landscape in relation to other major man-made and natural features. Viewed close-up, HST aerial structures must be sensitive to pedestrian scale. They should therefore convey an attractive and harmonious composition of structure and architecture.

Sandstone Colored Concrete

Natural Grey Concrete

California High Speed Rail Aerial Structure Images

HST Aerial Structure Defined

A HST railway aerial structure is a continuous elevated trackway consisting of moderate-length and consistently-spaced segments spanning across obstacles such as roadways, railways, valleys, or water features. HST aerial structures may be distinguished from HST bridges and overpasses by their repetition, continuity and shorter spans whereas HST bridges and overpasses will likely be unique solutions to unique design conditions. Primary HST aerial structure components include columns and girders. Secondary components may include straddle bents, pocket tracks, sound barriers, and the overhead contact system (OCS).

Spain HSR Aerial Structure

Taiwan HSR Aerial Structure

3.1.2 Aesthetic Principles for HST Aerial Structures

General

HST aerial structures should exhibit appropriate scale, balance, symmetry, unity and proportion in aesthetic design, i.e., proportional relationships of height, width and thickness of structure should convey slenderness, strength and durability.

Aesthetic design of HST aerial structures should fit with, contribute to, be harmonized with and sensitive to the surrounding visual landscape. Where HST aerial structures go through previously undeveloped locations, thoughtful aesthetic design of structures, topography and vegetative restoration shall be a high priority.

Consistency and Unity

A. HST aerial structures should present a high level of project-wide aesthetic consistency and unity within regional contexts. HST aerial structures are to be attractive, expressing elegance in efficient structural design. Combining aesthetic design of HST aerial structures, landscape and urban design can create a positive contribution to the surrounding visual context. Unity of design strives for regional consistency while allowing local variation in HST aerial structure appearance, such as at stations and station approaches, or to address unique community contexts as described in these guidelines.

B. Consistent span lengths are desirable in order to establish a visual rhythm. Distances between columns or piers shall be optimized structurally and standardized visually to the

greatest extent possible with a typical span being approximately 100 - 120 feet.

C. Although span consistency is a system-wide aesthetic objective, resonant frequency must also be considered for long HST aerial structures. Span lengths for high-speed train structures generally cannot be constant over multiple spans for long distances due to harmonics, which can induce a resonance of the train and the structure and can affect structural performance and passenger comfort. This condition can typically be mitigated by including an odd span length to break the natural harmonics. A long HST aerial structure where typical spans are 100 feet should include two shorter 75 or 80 foot spans every 20 spans or thereabouts. The odd spans should not be common divisors of the typical spans (such as a pair of 50 feet spans).

French HSR

Japanese HSR

Consistent Spans and Column Sizes

Inconsistent Spans: Spain HSR

D. As tracks gradually ascend to clear existing structures, or as the level of the existing topography drops along the alignment, column size should not vary in cross sectional area within a series of spans until an appropriate landscape feature or HST structure (station, tunnel portal, abutment, etc.) provides an appropriate point of transition.

E. Design and construction teams shall coordinate points of design interfaces with adjacent contracts to ensure aesthetic consistency between construction segments. Significant changes in construction methods resulting in noticeable variations within a single series of HST aerial structure spans shall be avoided.

F. A series of girder spans should maintain a consistent cross sectional profile, even when varying spans might permit structural differences in girder depths. Abrupt changes in structural member sizes or proportions of HST aerial structures should be avoided.

G. Quality control of concrete batches and formwork shall be closely monitored to ensure visual consistency between segments.

H. Particular attention shall be given to consistency of secondary elements visible from below, including soffits, finishes, drainage components and power/systems conduits.

I. As appropriate, CHSTP concrete structures should be identifiable by their use of consistent integral color. Three shades of color additive will be designated as acceptable concrete infrastructure colors.

Variability

HST aerial structure design should strive for regional consistency, yet respond to and respect distinctive local context. Elements of aesthetic design variability include span lengths, column height and shape, column capital vs. column flare, girder slope, overhang, taper, soffit, parapet height and sound wall. Similar to the station design process, there shall be a collaborative effort between designers and stakeholders to develop quality aesthetic design and mitigate visual impacts.

Taiwan HSR: Aerial Structure Variability (note varied columns, caps, girders, sound walls, etc)

Simplicity

HST aerial structures shall be visually uncomplicated and structurally efficient assemblies. Essential aesthetic quality should emanate from flowing line and proportion inherent in the primary structural elements.

Decorative elements, patterns, textures may be used on extensive flat surfaces to create shadow lines or to adjust or improve the perceived proportions of a HST aerial structure. Applied colors or textures that may require routine maintenance and/or replacement, are not recommended.

Construction Materials

Concrete structures are generally preferred over steel structures due to their cost, strength, low maintenance and inherent, almost limitless ability to be formed into shapes, curves, bevels, reveals and other architectural profiles. In some situations, steel elements may be preferred over concrete due to lighter weight and specific construction conditions such as constructing over operating railroads.

Artwork

Consistent with federal, state and local policies promoting the integration of art into public buildings and places, artistic expression can be integrated into CHSTP structures when appropriate and feasible in accordance with Authority policy on public art.

3.1.3 Site Factors

Integration into Urban Context

While HST aerial structure structures introduced into urban areas must satisfy their primary engineering function, they should also be designed with sensitivity to surrounding communities

and businesses. Care should be exercised to avoid physically dividing communities and altering the character of neighborhoods. HST aerial structures and associated landscape and hardscape features should be judiciously placed, sized and detailed.

Sun and Shadow

Sun and shadow conditions will be altered by the introduction of HST aerial structures into the urban context. Portions of the community will be shaded by new structures. Consideration may be given to special spacing of HST aerial structure piers to reduce shadows at sensitive locations. Where wider trackways are required, such as at station approaches, individual girders may be considered to allow sunlight to penetrate between girder decks.

Preservation of Natural Rural Environments

In some cases, the greatest contributor to the aesthetic character of HST structures will be the surrounding natural environment. Therefore HST aerial structures which pass through undeveloped environments should be designed with sensitivity to this context. Preservation of natural character, habitat quality and migratory corridors will be priorities. Native vegetation should be restored in kind.

Utilization of Space Under HST Aerial Structures

Space underneath HST aerial structures located within the right-of-way can be usable for purposes unrelated to high-speed rail, per the Authority's policy on air-rights consistent with restrictions related to HST operations, maintenance and security. Appropriate uses under HST aerial structures are to be identified by Authority policy, such as active uses that enhance community quality of life, safety, accessibility, economic development, and/or other community serving uses.

Community Involvement

After a HST aerial structure profile is established during or following the environmental review process, communities may be invited to provide additional input on aesthetic design and/or use of public spaces underneath the HST aerial structure for public uses

3.1.4 Horizontal Components

Trackway Height

Where it is necessary for a HST aerial structure to pass over existing roadways, railways or other infrastructure, consideration may be given to providing clearance in excess of the minimum required. Views to and from existing buildings or natural features should be considered and an optimum height established which considers human scale, views and a recognition that higher HST aerial structures will typically be less imposing and oppressive than low HST aerial structures when viewed from street or ground level.

Low Clearance: Rome

High Clearance: Taiwan

Trackway Height

Trackway Consistency

Alignment of adjacent horizontal units should be smooth and consistent. Where long sections of HST aerial structure are visible from a distance, straightness should not be interrupted with abrupt changes in elevation or curvature

Visual Inconsistency

Visual Consistency

Dubai Metro Aerial Structure

Trackway Width

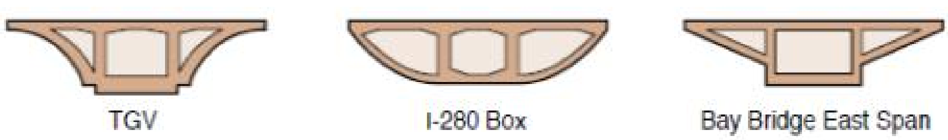
The width of trackway structure supported by columns is a function of the number of tracks required for operation, track spacing, walkway and cable tray widths, and space for OCS poles and/or sound barriers, if required. The overall width of the combined trackway components should be kept to the project standard minimum in order to reduce the visual impact, shadow casting, and required right-of-way. Where trackways widen at approaches to stations, storage tracks or crossovers, the same principle applies to reduce the component width.

Box Girders

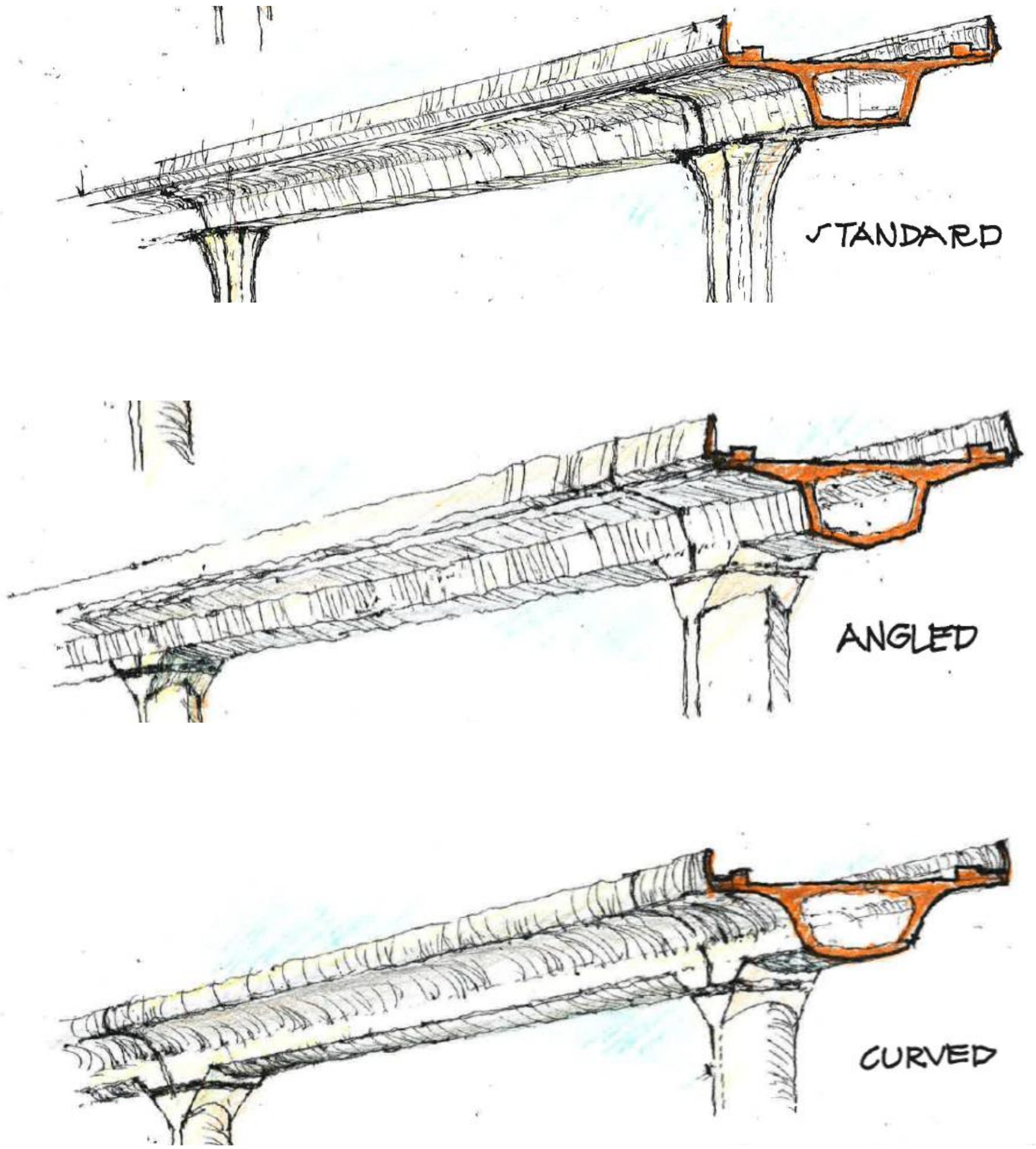
Each box girder section will typically support two running tracks, communications conduits, emergency walkways, OCS poles, and parapet walls. Box girders can be assembled side by side when more than two tracks are required. A positive, upward camber is generally the preferred profile for the bottom of long box girders.

A. Girder Shape: Box girder shape may significantly influence the perception of structural mass. Angling girder sides and soffits creates a deep shadow and reduces the perceived girder depth. Curving the girder sides and soffits eliminates sharp shadow lines and presents a softened appearance. The potential girder shapes illustrated below may be constructed in precast single spans, precast segmental or cast-in-place methods.

Potential HST Girder Shapes



Unique Box Girder Shapes



Girder and Column Coordination

Spain HSR Box Girder

France HSR Box Girder

Box Girders

B. Girder Soffits: The undersides of HST aerial structure girders and projecting cantilevers, viewed from below, are often the most visible portions of structure. Transitions from the soffit of the box girder to the tapered sides and from the sides to the cantilever should be detailed to integrate a generous radius or transitional slope. Radiused or sloped corners, both inside and outside, provide a smooth transition between vertical and horizontal portions of the girders.

Particular attention should be given to the quality and consistency of concrete finish at the soffits of box girder sections within stations if girders are intended to remain exposed within the station.

Taiwan HSR

Korea HSR

Girder Soffits

Storage Tracks and Crossovers

Ideally, storage tracks should not occur on HST aerial structures. However where storage tracks are unavoidable on HST aerial structures, transition to a wider girder section should be smooth, long, and continuous. Crossovers in the running tracks should not require special HST aerial structure construction that would create inconsistency or aesthetic concerns.

Straddle Bents

Straddle bents are used where columns cannot be located under the guide way, such as highway and railroad crossings. These should be consistently detailed and aesthetically compatible with other standard HST aerial structure proportions, detailing and finishing. Avoid dissimilar or unrelated structural detailing.

Composite Bent: Not Preferred

Integrated Bent: Preferred

Straddle Bents

<u>HST Aerial Station Structures</u>

At elevated stations, HST aerial structures will run continuously from station approaches through the station. The majority of intermediate HST elevated stations will likely be configured with platform stopping tracks and side platforms outboard of center through-tracks. As such, the HST aerial structure can be considered a continuous structure through the station enclosed by an architectural envelope.

Shin-Aomori Station, Japan HSR

Station architecture and structures should be coordinated using standard modular dimensions in order to provide a consistency and economy of station finish materials. It may be appropriate to adjust typical HST aerial structure column spacing, size, and profile within the station zone in order to make interior columns within sight and touch of the public more suited to human scale. It may also be advantageous to raise track profile columns slightly to allow adequate height for a mezzanine or to achieve a sense of volume within station public areas.

Hsinchu HSR Station, Taiwan HSR

Shin-Tosu HSR Station, Japan HSR

Aerial Structure Column Interface with Station

HST aerial structure columns within station interior public areas should be sized, shaped and located to avoid creating obstructions to passenger flow and with regard for aesthetic unity.


Hsinchu HSR Station, Taiwan HSR


Taichung HSR Station, Taiwan HSR

Aerial Structure Column Interior Placement

3.1.5 Vertical Components

<u>Columns/Piers</u>

A. Shape: Columns for support of trackway HST aerial structures may be round, oblong, square, or rectangular in cross section. Within populated areas however, round or oblong columns are preferred to meet Crime Prevention through Environmental Design (CPTED) safety recommendations and to optimize seismic detailing. Column design and detailing should display consistency which identifies the structures as components of the CHSTP.

Potential Column Cross Sections


Oblong piers, Taiwan HSR


Round Columns, Korea HSR

Column Shape

B. Proportion: Column width and height should be structurally optimized to accommodate existing site conditions and for economy. However, there may be cases where the columns should be oversized in order to improve the proportion of height to thickness; i.e., a tall column may be deliberately thickened in order to improve the proportion of thickness to height and thereby improving its perceived strength.

C. Multiple Columns: Single columns spaced at a consistent distance are preferred over pairs of columns. However multiple columns may be appropriate at specific locations.

Multiple columns: Ruyff Valley Aerial Structure, Belgian HSR

D. Column Flare: Column profiles may be flared out at the top for a more graceful transition to the column capital or beam.

Spain HSR

Meuse, France HSR

Flared piers

E. Patterns: In urban areas, columns may be finished with cast-in patterns and textures that recognize local preferences and/or historical characteristics.

Phoenix Light Rail

Texas Highway

Patterns and Textures

F. Column Caps: Caps may or may not be utilized depending on the aesthetic approach selected. However, the preferred approach is to reduce the number of structural elements within the HST aerial structure unit to achieve clean visual lines, i.e., elimination of column caps as separate structural elements where structurally feasible. The interface between column and box girder is an important aesthetic detail warranting attention and coordination.


Preferred


Not Preferred

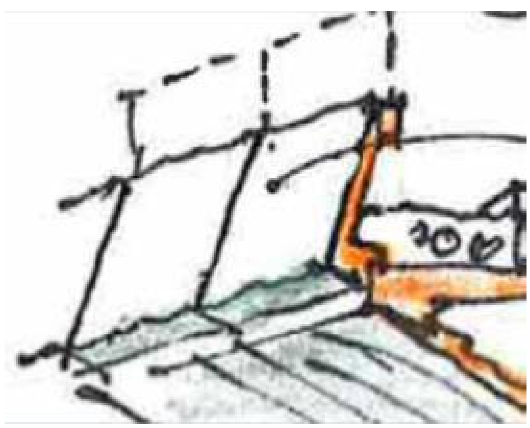
Column Caps

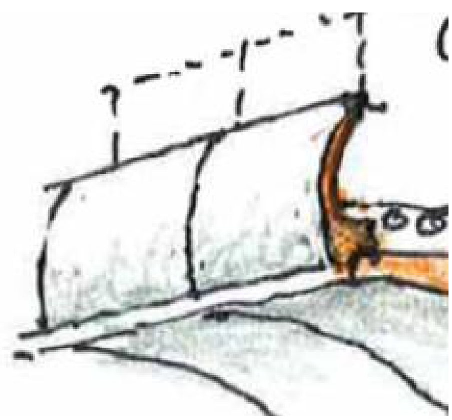
<u>Sound Walls</u>

Train noise may be dampened by continuous vertical sound walls attached at the exterior edges of HST aerial structures or located along the right-of-way to be closer to the noise receptor. These walls shall be as high as required to mitigate noise (at locations where a mitigation need has been identified) while remaining sensitive to the passengers' preference for a low wall to allow views. Although low walls are minor structural elements, they influence the overall appearance of the HST aerial structure assembly and should be detailed with aesthetic care.

The shape of parapet walls shall be appropriate for the girder shape, with consistently spaced joints. Changes in wall shape should only occur at major structural transitions (HST aerial structure to grade, HST aerial structure to tunnel portal, etc).

Where sound mitigation necessitates high walls which obstruct passenger views, transparent noise barriers may be considered, combining a metal framing system with glass or other transparent material.


Sound Wall/ Parapet for Angled Girder


Sound Wall/ Parapet for Curved Girder

External Sound Wall/ Parapet

Solid Transparent

External Sound Walls

Sound walls can significantly influence the overall proportions of a section of HST aerial structure. The continuous vertical surface areas of sound barriers provide an opportunity to integrate aesthetic surface treatments where walls face urban areas.

Where sound walls occur near or within stations, integral patterns may be considered for inward-facing vertical surfaces for viewing by passengers on platforms.

Taiwan HSR Korea HSR

Internal Sound Walls

Security/Safety Barriers

Vertical barriers along trackways will be highly visible components and should present a simple but studied exterior and interior appearance. Typical safety barriers along running trackways should be simple guardrails to satisfy statutory life safety requirements for railings. In areas where the safety barrier is a solid material such as concrete, the exterior (and interior where appropriate) surface may be detailed with integral patterns and textures similar to sound walls.


Korea HSR


Spain HSR

Security/Safety Barriers

Access/Egress Stairs

HST aerial structures may require stairs to provide emergency egress or maintenance access. These stairs will be visible in both rural and urban areas. Stairs in urban areas should be designed as essential HST aerial structures first and second as opportunities for expression of functional sculpture. Existing urban context can also provide opportunities for expression of local identity and compatibility.

As potential access points to the trackway, unauthorized access to these stairs must be prevented through use of fences and lockable gates which combine security with aesthetically appropriate fence design.

Aerial Structure Stairs: Taiwan HSR

3.1.6 Aesthetic Detailing

Purposes

Structures should integrate aesthetic detailing where exposed to public view. HST aerial structures are often repetitive and continuous structures and their aesthetic qualities may be accentuated by detailing with reveals, patterns, curves, chamfers, and accentuated joints to create shadow lines. This detailing may be vertical, horizontal, circumferential, and projected or recessed in order to convey a sense of depth and visual character.

Patterns and Shadow Lines

Vertical reveals or patterns are preferred over horizontal; vertical articulation will generally retain less dust and dirt and therefore will cause less staining resulting from rainfall.

Long, continuous vertical elements such as parapets and sound barriers are desirable locations for integration of patterns, reveals, or other aesthetic detailing. In urban locations close to stations, patterns or bas-reliefs may be integrated into vertical elements in order to satisfy art integration principles and requirements.

San Francisco BART: Wall Pattern and Line

Korea HSR: Sound Barriers

Concrete Pattern and Texture

Fencing

Fence context will heavily influence selection of fence materials and detailing; fences in highly visible or aesthetically sensitive locations shall be designed to a higher level of care and quality than low-visibility fencing.

3.1.7 Site Considerations

Community Collaboration

Use of land underneath elevated HST structures will be determined collaboratively by the Authority and the community/region through which the structure passes. The standard approach to site use will be to reinstate the land to its use prior to HST construction. However, alternative uses may be considered based on technical and economical feasibility, including landscaping, parks, public artwork, roadways, parking, utility stations or other uses as deemed acceptable by the Authority.

Public space beneath elevated structures should promote public safety and attractiveness, contributing to the aesthetic quality of the community/region. Pedestrian and bicycle access routes shall be maintained or reinstated.

Landscaping Beneath HST Aerial Structures

A. General: Landscaping may be used to soften the presence of HST structures in urban and rural environments and reduce the apparent scale of elevated structures. Plantings selected shall be consistent with native and prevalent local species. Landscaping may be utilized to create visual interest for pedestrians and bicyclists. Drought-resistant plants shall be selected wherever reasonable. Landscaping may be a deterrent to graffiti on HST structures. Aesthetic design shall consider provision of adequate right-of-way for landscape screen plantings.

B. Urban Areas: Plantings may be used in urban locations to visually integrate HST infrastructure into the local context and create visual unity in highly visible locations. Plantings can introduce color and texture and become a visual focus in the foreground to filter views of HST structures. Pocket parks may be introduced under HST aerial structures to create recreational opportunities. Rows of tall, closely-spaced street trees may also screen HST structures from public view in visually sensitive neighborhoods.

C. Rural Areas: Plantings in rural locations, including agricultural and open space shall recreate the natural setting into which HST structures are constructed.

Maintenance

Plantings shall be selected for low maintenance wherever reasonable. Responsibility for maintenance of space beneath HST elevated structures will be as described in section 3.5.

Urban Landscaping: pocket park

Rural Landscaping

Landscaping Beneath Aerial Structures

Public Artwork

Consistent with federal, state and local policies promoting the integration of art into public buildings and places, artistic expression should be integrated into CHSTP structures when appropriate and feasible. Space may be identified by the Regional Consultants and the community for introduction of artwork underneath HST aerial structures. Candidate locations for artwork shall have high potential for public visibility and public use. Artwork should enhance and reflect the unique character of the surrounding neighborhood or geographical region. Artwork may be freestanding or attached to HST facilities.

The Authority will engage with communities to establish a budget for public art appropriate for the HST project and consistent with state and national policies. Refer to section 3.5 Roles and Responsibilities for further information.

3.1.8 Systems Integration

OCS Supports

The overhead contact (catenary) system (OCS) will comprise a significant visual presence along the entire length of the CHST. Although the OCS function mandates rigid geometric standards in relation to the HST vehicles, the steel OCS supports may be shaped or configured in a way which reduces or enhances their visual impact. Where station configuration allows, the OCS may be suspended from overhead station superstructure which will allow elimination of standard OCS poles along the platform length.

Conduit Integration

Where trackside power and communications cables enter the station zone or rise from ground level to HST aerial structure level, cables should be integrated into the structural system. Cables and ducts should not be mounted to structural members without prior aesthetic planning. Exposed cable trays and duct banks should be either recessed into structural members or covered with appropriately coordinated, removable cover plates with access panels.

Drainage Integration

Pipes functioning as drainage leaders for HST aerial structures and elevated station drains should be integrated into structural members within urban areas. In urban areas, it may be desirable to cast a recess into the surface of columns to recess the vertical leaders for concealment and to protect them from damage. Beyond urban areas, external rain leaders may be secured to the outside of columns.

Integrated Drainage

Non-integrated Conduits

Integration of Drainage on Structures

Signage

Signage mounted to HST aerial structures will conform to the CHSTP Signage and Graphics standards.

Lighting

In special cases, it may be appropriate to illuminate exterior surfaces of trackways and/or columns within developed areas for a dramatic effect. Refer to the Lighting section under HST bridges and overpasses for similar aesthetic guidelines.

3.2 HST BRIDGES AND OVERPASSES

3.2.1 General

Introduction

Bridges and overpasses have symbolic as well as functional importance. Bridges and overpasses connect places, communities and people. A bridge or an overpass has the potential to be a more significant object than simply a utilitarian connector between two points. Unique and creative bridge and overpass forms have the potential to stir the imagination and render the landscape even more inspiring than its natural state.

This section sets forth the fundamental aesthetic concepts of HST bridge and overpass design.

Sydney

Natchez Trace, Tennessee

Big Sur, California

Tunkhannock, Pennsylvania

Inspirational Bridge and Overpass Designs

HST Bridge and Overpass Purposes

Numerous HST bridges and overpasses will be needed throughout the HST system to carry high-speed trains as well as conventional railroads, highway vehicles and pedestrians across a diversity of geographical and topographical conditions. HST bridges and overpassss should visually exemplify the efficiency, strength, permanence and beauty which characterize the Project.

HST Bridge and Overpass Functions

In contrast to HST aerial structures, HST bridges and overpasses will typically be required where shorter, standardized HST aerial structure spans are not feasible. By Project definition, HST bridges will be required where high-speed trains cross waterways. HST overpasses will cross canyons, highways, railways or grade separations. HST bridges and overpasses are physical connectors with potential to become urban or rural landmarks.

3.2.2 Aesthetic Principles for HST Bridges and Overpasses

While there are no absolute rules by which the visual impact of HST bridges and overpasses can be evaluated, the following principles, derived from successful bridge and overpass solutions elsewhere, should be followed in the design of HST bridges and overpasses.

Simplicity

HST bridge and overpass forms should utilize contemporary technology to emphasize simplicity, lightness and gracefulness.

Yangtze River, China

Linearity

HST bridge and overpass appearance will generally be optimized when its horizontal lines are extended as far as possible. Extending guard rails, parapet walls or barriers beyond the face of abutments accentuates linear character and helps visually anchor the HST bridge or overpass to the ground. Cantilevered decks, railings, and parapets can create strong shadow lines to reinforce the horizontal lines of the HST bridge or overpass.

Proportion

All HST bridge and overpass types should exhibit principles of correct proportion, i.e., the relationship of height, width and thickness, to convey slenderness and strength.

Variability and Commonality

HST bridges and overpasses will be built in widely diverse locations and will span across a wide variety of conditions, from urban to rural, high to low visibility, in residential, commercial, industrial, agricultural, and natural settings. Context-sensitive design solutions are encouraged in a collaborative process with local stakeholders. Common attributes will include quality, longevity, life cycle value and low maintenance.

Public Artwork

Consistent with federal, state and local policies promoting the integration of art into public buildings and places, artistic expression should be integrated into CHSTP structures when appropriate and feasible. Refer to section 3.5 Roles and Responsibilities for further information,

Cultural Context

In some cases, HST bridge and overpass design may respond directly and literally to the unique cultural or architectural context into which it is to be built, reflecting intrinsic values, culture or tradition.


Kanchanapisek Bridge Thailand


Esfahan, Iran

Cultural Context

Natural Context

Indigenous materials may be considered in HST bridge and overpass design where a specific contextually sensitive environment such as mountains, canyons or waterways renders conventional materials inappropriate. Approaches, abutments or other transitional structures may consider use of local materials.


Glen Canyon, Arizona


Pont du Gard, France

Natural Context

Viewpoints

HST bridge and overpass design should take advantage of potential public viewing opportunities whenever they occur. As locations for landmark structures are identified by a community, full opportunity should be developed to integrate a HST bridge and overpass into the natural landscape or accentuate a major urban feature such as a gateway into a city center.

Lighting

Where justifiable by potential views and public interaction, HST bridge and overpass aesthetics may be accentuated with the use of accent lighting. Selection of energy-efficient lighting systems is a critical factor in the decision to illuminate HST bridge and overpass exteriors. Use of cut-off fixtures around the light source will limit or prevent light pollution.


Tower Bridge, London


Roosevelt Bridge, Stuart, Florida

Bridge and Overpass Lighting

Maintainability and Finish Materials

Maintenance, durability and longevity of structures are primary concerns. Reinforced concrete requiring no finish treatment and minimal maintenance is the preferred structural and finish solution. Integral color may be considered where raw grey concrete color is not appropriate in the surrounding context. If steel is determined to be the preferable superstructure material, surfaces shall be protected with a high-performance, long-lasting coating in a context-sensitive color.

Interfaces with Other Structures

Special site conditions or irregular spans within a HST aerial structure section may necessitate a special HST bridge or overpass section. This interface between HST bridge or overpass and HST aerial structure or trackway should clearly emphasize the transition to a special structure.

Where HST bridges and overpasses abut an at-grade section of trainway, the transition should be simple and graceful using a contextually appropriate material and finish.


Cologne-Rhine, Germany


Mosel, Germany

Bridge and Aerial Structure Transitions

3.2.3 Site Factors

Urban Sites

Just as the site conditions, context and span influence the choice of structural system for an urban HST bridge or overpass, these are primary determinants in aesthetic treatment of an HST bridge or overpass. Future land use must be considered; a HST bridge or overpass crossing industrial land today may cross over a housing development in the future. Urban character will change over time; HST bridges and overpasses must be designed with this fact in mind.

Public exposure must always be a factor in aesthetic decisions. Whereas a HST bridge or overpass spanning a railroad switching yard may be seldom seen by the public, a HST bridge or overpass spanning a public highway will be viewed countless times each day and its exposure may warrant special design treatment.

Tsing Ma Bridge, Hong Kong

Overpass in San Diego

Urban Bridges and Overpasss

Space Under HST bridges and overpasses

Space beneath HST bridges and overpasses provides opportunities for development of parks and other public spaces. Where adequate height would allow sunlight to penetrate under an HST bridge or overpass, consideration should be given to developing public space beneath it.

Park under Urban Bridge, Sydney

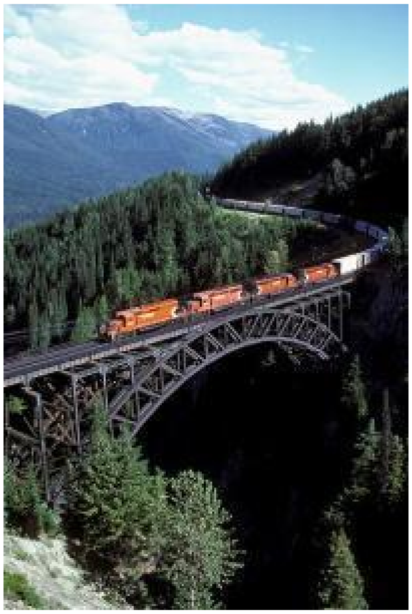
Cathedral Park Bridge, Portland

Space under Bridges and Overpasses

Rural Sites

A remote bridge or overpass in a rural setting may be viewed less frequently than an urban highway span. However, remoteness does not relieve the need for aesthetic care. In fact, a rural context often renders the aesthetic character of a bridge or overpass even more critical due to the importance of complementing its natural setting. HST bridge and overpass components should conform to the natural topography.


Suburban Minneapolis


Glacier Park, Montana

Rural Bridges

Abutments

The hard, straight lines of a HST bridge and overpass structure should transition gently into the soft lines of the natural terrain of the countryside. Abutments are best left open and sloped to meet the underside of the girders.


Natural Abutment, Spain HSR


Retained Abutment, France HSR

Abutments

3.2.4 Structural Factors

HST Bridge and Overpass Superstructure: Types and Materials

Selection of bridge or overpass superstructure is highly dependent on location, span, design loads and purpose. The superstructure form selected will establish the overall aesthetic character of the HST bridge or overpass. Superstructure may be constructed of reinforced concrete or steel. Generally, lighter, thinner structural members will result in a more pleasing appearance. Depth of structural members is highly dependent upon span length; in order to lighten horizontal members, spans may be shortened and columns increased.

Representative HST bridge and overpass types include the following:


Concrete Arch, Cologne-Rhine, Germany


Steel Girder, Mosel, Germany


Steel Arch, Korea HSR


Steel Truss, New York


Cable Suspension, Hong Kong


Cable Stayed, East Huntington

HST Bridge and Overpass Types

Substructure

HST bridge and overpass substructures may be nearly as visible from below as the superstructure. As the examples above illustrate, a visually successful bridge or overpass integrates visible structural elements into a cohesive design.

Seismic Considerations

California's structural design standards often result in bridge and overpasss with robust individual members and a stout presence. When a structural member appears to be out of proportion compared to other members, bridge and overpass proportions should be carefully adjusted.

3.2.5 Functional Approach

General Principles

A typical HST bridge or overpass will employ conventional engineering methods. Type and material selected will be appropriate for the location and purpose without necessitating a specialized or innovative approach. Typical highway bridges and overpasses will follow Caltrans aesthetic standards.

Aesthetic Principles

HST bridges and overpasses will satisfy the Project's design excellence goals. Designs shall integrate aesthetic character together with resolution of each structure's unique functional requirements (span, column size and placement, optimal structural type). Simplicity and the design objectives described in this document should be the primary aesthetic drivers.

Context

The emphasis of aesthetics relative to functionality will be dependent upon the visibility of the HST bridge or overpass and the degree of involvement and financial partnering requested by community stakeholders. The level of aesthetic emphasis will not necessarily depend upon an urban or rural setting. Some communities may prefer a simple HST bridge or overpass to avoid drawing attention to it while another community may choose an "iconic" design to create a special aesthetic emphasis as described in the following section.

3.2.6 Iconic Approach

General Iconic Characteristics

As an alternative to functional design, local agencies desiring a more dynamic and impactful HST bridge or overpass presence may choose to work with the Authority to develop an iconic design. Iconic HST bridges and overpasses shall satisfy HST functional requirements but with a greater emphasis upon aesthetics. Iconic character is not necessarily a response to a particular urban location or a highly-visible context; any HST bridge or overpass may be considered for iconic design. An iconic HST bridge or overpass may be characterized by a sense of prominence in the environment, structural innovation, aesthetic expressiveness, organic or curvilinear form, unique detailing and/or rich materials.

Specific Iconic Attributes:

- **Innovation.** Iconic bridges and overpasses may provide unique, innovative and creative solutions to challenging spans or settings. They are originals, not merely copies of other bridges and overpasses. They may push or break the limits of engineering ingenuity and may be constructed using advanced materials and techniques.
- **Beauty.** The beauty of an iconic bridge or overpass can leave a lasting impression upon the viewer through the creative use of form, line and color.
- **Harmony.** An iconic bridge or overpass appears to have been custom-designed for its unique surroundings. It harmonizes with and complements its surroundings.
- **Clarity.** An iconic bridge or overpass generally expresses how it functions. Its structural behavior is generally simple and understandable to the public.
- **Recognition.** An iconic bridge or overpass may become a landmark, easily recognizable by the general public, symbolizing the people or community for whom it was built.

Alamillo Bridge, Spain

Da Vinci Bridge, Norway

Kubitschek Bridge, Brasilia, Brazil

Iconic Bridges

3.2.7 HST Pedestrian Bridges and Overpasses

General

HST pedestrian bridges and overpasses will be provided throughout the CHST for the use of rail passengers, urban pedestrians, rural walkers and bicyclists.

Context

Pedestrian bridges and overpasses connecting to stations shall be integrated into the station design. In urban contexts remote from stations, HST pedestrian bridges and overpasses should be visually compatible with the context. In rural areas they should complement the existing terrain and vegetation.

Image

Pedestrian bridges and overpasses can be functional or iconic in the same sense as HST rail and highway bridges and overpasses. Relatively light loads often allow innovation and creative engineering.

Safety

Pedestrian bridges and overpasses over railways or highways shall be partially or totally enclosed to prevent objects from falling onto the tracks or OCS system.

Coordination

As locations of HST pedestrian bridges and overpasses are identified, local planning officials shall be consulted to integrate the site details with specific area plans, urban design plans, related property development, bike routes, etc.

Functional: Jack London Square, Oakland, CA

Functional: Route 9, MTA New York

Iconic: Sundial Bridge, Redding, CA

Iconic: Schroder Bridge, Walnut Creek, CA

Pedestrian Bridges and Overpasses

3.3 TUNNEL PORTALS AND VENTILATION STRUCTURES

3.3.1 General

Tunnel portals will significantly contribute to the system-wide visual image of the CHST. Portal aesthetic and technical solutions shall be developed concurrently. Unlike automobile tunnels, high-speed rail portals will not be perceived by passengers. Nevertheless, portals will be visible from multiple vantage points; in remote mountainous areas and agricultural lands as well as from developed urban settings. The portal context will largely determine whether each portal will be blended into the local environment or distinguished from it through the use of distinctive architectural features.

This section describes aesthetic guidelines and concerns specific to tunnel portals and tunnel ventilation structures. Detailed information describing technical design elements required for tunnel portals are found in Technical Memorandum 2.4.6, HST Tunnel Portal Facilities.

3.3.2 Portal Components

Components of tunnel portals requiring aesthetic consideration include:

A. Noise Mitigation Hoods: Hoods may be necessary at portals to mitigate noise radiating out from the tunnels as trains enter and exit, and to protect trains and facilities from debris falling from adjacent slopes. These arching concrete tunnel extensions will vary in

length and may flare out at the portal. Hoods may be exposed or backfilled and landscaped. The primary aesthetic medium will be the surrounding landscaping; however the exposed concrete may be distinctively detailed.

B. Ventilation Structures: Required for longer tunnels, ventilation structures over the tunnel openings could be two or three stories in height and may including traction power, facilities power, telecommunications and signaling, maintenance and fire protection in addition to ventilation equipment space.

C. Traction Power Facilities (freestanding): Generally located remotely from tunnels. The degree of aesthetic treatment will depend upon the location of the facilities, i.e., high or low visibility.


Korea HSR Tunnel Portal

Portal Components

3.3.3 Aesthetic Principles for Portal Design

Configuration

Depending on the tunnel configuration selected, portals may be configured for either two parallel single track tunnels or a single, larger diameter, dual-track tunnel. The exposed portal face may be vertical or sloping to follow the natural topography as much as forty-five degrees, depending on site conditions and train speed.


High Speed, Sloping Face, Korea HSR


Low Speed, Vertical Face, Japan

Portal Face Slopes

Interfaces

Where HST aerial structures or trainway berms transition into tunnel portals, the transition shall be as natural and seamless as possible, utilizing coordinated and contextually appropriate materials, textures and detailing of exposed surfaces.

Drainage

Slopes above tunnel portals require storm water diverters to protect the portal opening and trainway facilities. Drainage channels should be integrated into the portal design.

Landscaping

Portal design should strive to minimize disturbance to existing slopes. Cut slopes and native vegetation surrounding portals should be restored to a natural state with smooth, natural transitions. Hood extensions may be backfilled and replanted with native species. Once established, landscaping should not require irrigation or maintenance except in urban areas where a portal interrupts existing landscaping; relocated or restored plant materials should be used to create a seamless interface with the existing site area.

Low Maintenance: German HSR Portal

Natural Vegetation: French Highway Portal

Portal Landscaping

Finish Materials

Tunnel portals will likely be constructed with cast in place concrete. Concrete finish may be integrally colored to blend into the surrounding environment. Large concrete surfaces at vertical portal walls or ventilation structures may be articulated with integral color or applied texture to establish an appropriate relationship between manmade forms and the existing natural landscape.

Spain HSR

Spain HSR

Applied Portal Finish

Urban Portals

Where trainways enter trenches visible within an urban environment, consideration may be given to dramatic architectural expression at the portal, in accordance with HST aesthetic principles. As a portal enters a trench, the cover may be landscaped to create a park-like setting. Highway tunnel portals found in urban settings as shown below exemplify urban portal types.


Trench Portal with Landscaping


Architectural Portal

Urban Portals

Artwork

The vertical face of a tunnel portal may provide an excellent opportunity for large-scale artwork, signage or bas-relief sculpture. As a tunnel portal will not be visible to the HST riders, this is a practical approach only where the portal will be frequently viewed from the surrounding area.


Murals


Graphics

Portal Artwork

3.3.4 Aesthetic Principles for Ventilation Buildings

Ventilation Buildings

Portions of tunnel ventilation structures may be exposed as much as thirty feet above the tunnel or surrounding grade. These structures require aesthetic attention not unlike other smaller HST facilities. Where a ventilation building is freestanding, its architectural expression should recognize the site context, system image and presence within the environment.

Hong Kong MTR

Taiwan HSR

Ventilation Structures

Integration of Portal and Ventilation Shafts

Ventilation structures, where integrated into tunnel portals, may be appropriate locations for unique aesthetic/architectural expression. Where portal and ventilation shafts are in close proximity, construction, finish materials and detailing should be harmonized.

3.4 RETAINING WALLS

3.4.1 General

This section outlines aesthetic guidelines for design of retaining walls, noise barriers and collision intrusion protection barriers. Although retaining walls are primarily structural elements, their significant height and breadth relative to ground level necessitate aesthetic attention. Retaining walls will contribute significantly to the visual character of HST facilities and infrastructure. Careful consideration of wall height and surfaces treatments will incorporate walls favorably into surrounding landscape.

3.4.2 Aesthetic Principles for Retaining Walls

Site and Context Factors

The built environment and the natural environment as they exist within and around retaining walls will influence retaining wall aesthetic design. Walls should be coordinated with adjacent HST bridges and overpasses, HST aerial structures or other structures and should blend with surrounding landscape. Railings, guardrails and parapets should be coordinated with those on surrounding HST bridges, overpasses, aerial structures or existing walls to create a harmony of materials while making a distinctive aesthetic statement for the high-speed train system. Retaining walls should express continuity of design within specific regions.

Consistency

Retaining wall design elements within a particular site area or a regional corridor should convey a consistent aesthetic character. Wall design elements for which consistency is important include exposed concrete finish, texture, color, top of wall detailing and railings.

Height

Although retaining wall heights are often no more than a few feet above adjacent grade, higher walls may present a highly visible feature upon the landscape. As such, walls and retained fill should be kept as low as possible. Effective wall height can be reduced by different means, including:

- Terracing
- Emphasizing horizontal lines rather than vertical
- Raising or varying top of grade at the base of wall to reduce apparent grade differential
- Adding plantings at the base and the tops of walls.
- Sloping tops of walls gradually or in small increments as the topography changes
- Using metal railings on top of walls (where required) in lieu of raising retaining walls

Effective Reduction of Apparent Wall Height

3.4.3 Wall Treatment

Structural Materials

Depending on the height, retaining or noise walls may be reinforced cast-in-place concrete, shotcrete, or soil nailed. Reinforced masonry may be cost effective on low to mid-height walls. Masonry options include split face units of many sizes. Mechanically stabilized earth walls may be used where structurally appropriate. Collision intrusion protection barriers shall be reinforced concrete.

Finish Materials

- Exposed cast-in-place concrete, plain or stamped using various types of formwork
- Concrete formliners
- Gunite/shotcrete
- Masonry veneers of brick, tile, or under special conditions, terra cotta
- Stone veneer
- Plantings to cover masonry or rough concrete
- Wall caps: precast concrete or stone
- Railings: stainless steel in high exposure, high moisture areas, otherwise galvanized and painted steel.

Terrraced Stone Veneer

Terraced Plantings

Retaining Wall Finish Materials

Surface Design Enhancements

General: Surface finishes will significantly influence the way a retaining wall is perceived. Some walls will be utilitarian and will not justify surface design enhancements. However walls with a significant visual presence justify a higher level of finish quality. Surface treatments for retaining walls can be integral or applied, however integral finish is preferred to minimize maintenance.

Planting: Integration of vegetation on top of, in front of, or attached to a retaining wall serves to soften the wall and provides visual relief.

Color: Wall color should be coordinated with surrounding built and natural features. Color can be integral with the structural material to reduce maintenance.

Bas-relief

Formliner

Retaining Wall Finishes

Texture/Pattern: Patterns and reveals use light and shadow to enhance wall surfaces. When considering a reveal or joint pattern, the length and height of the wall must first be considered. A long continuous wall may be visually shortened by adding a regular vertical pattern. A horizontal pattern tends to accentuate the length of the wall while reducing the perceived height. Patterned, rusticated concrete provides good visual interest, Bas-relief patterns may be considered to express a local theme or artistic sensibilities.

MSE Mechanically Stabilized Earth wall patterns

3.5 ROLES AND RESPONSIBILITIES

3.5.1 Purpose

This section identifies Authority and local agency roles and responsibilities related to aesthetic design of non-station structures, mitigation of visual impacts and allocation of capital and maintenance costs. The Authority may work with local agencies to define more specific roles and responsibilities depending on project needs and local circumstances.

3.5.2 Collaboration

The Authority seeks to collaborate with communities on aesthetic design and mitigation of visual resource impacts per CEQA and NEPA. The Authority is committed to achieving high quality design within project costs and funding. Local agencies along HST corridors can benefit by collaborating with the Authority early in the project delivery process; aesthetic design issues can be identified and creative, context responsive solutions that contribute to the unique character of communities can be incorporated into project design. A benefit to the Authority is establishing an efficient project delivery process that brings certainty to resolving aesthetic and visual resource impact issues with local agencies.

3.5.3 Aesthetic Design of Non-station Structures

Authority

At the Authority's discretion, the PMT can contact local agencies to provide input on aesthetic design of non-station structures. The PMT's role is to manage an efficient collaboration to solicit input, focus on aesthetic design, and work toward aesthetic design solutions that achieve design/build[1] procurement objectives. Design/build procurement objectives guide the way by which the scope of work for design/build proposals will be defined. For aesthetic design, procurement objectives include: 1) clarifying project scope to meet environmental and community commitments, 2) providing flexibility to enable innovative design, engineering and construction solutions (the synergistic relationship of designer and builder inherent in design/build to deliver the HST project on budget and schedule is beneficial to the Authority) 3) identifying quality of design and performance requirements so design/build contractors can compete to meet or exceed requirements, and 4) minimizing project risk and cost uncertainty by defining roles, responsibilities and schedule commitments with local agencies on project design and design review.

Local Agencies

Local agencies can request to work with the Authority to review aesthetic design per the roles and responsibilities of this section. Local agencies that are contributing funding or right-of-way, planning for HST station area development or use of air rights will be Authority priorities for local engagement on aesthetic design review.

The Authority expects local agencies to constructively engage with the Authority. Constructive engagement means participation of elected officials, local agency staff and representative stakeholders to identify aesthetic design outcomes and solutions that are locally acceptable, reasonable, within project costs and consistent with locally adopted plans. Local agency leadership is to be engaged and supportive of the process for the Authority to commit time and resources. Local agency staff is to be empowered to represent the community's position and make constructive recommendations that are supported by community leadership.

Process

The Authority and the PMT will assess where to collaborate on aesthetic design based on local agency participation in the HST project. The PMT will identify structural elements warranting local agency input and review and acceptance of aesthetic design and visual mitigations. The

[1] Design/build is the anticipated method of project delivery.

Authority, PMT and local agency will work together to establish a technical working group to conduct the work, select stakeholders, plan a progressive sequence of stakeholder discussion and input, and define shared process outcomes. Interviewing local and regional opinion leaders is recommended to gauge attitudes, select stakeholders that represent a balance of key interests, establish the process and identify outcomes. Local agencies and the Authority will mutually agree upon a schedule consistent with statewide program funding and schedule.

A baseline process to develop the aesthetic design content may include the following steps: 1) begin with the EIR/EIS visual impact assessment and recommended mitigations, 2) validate the location of key viewpoints and aesthetic elements that characterize the landscape unit(s), 3) identify shared aesthetic design issues, opportunities and outcomes, 4) explore context responsive aesthetic design solutions, using the guidelines as a design resource, and 5) select mutually agreed-upon and documented aesthetic design guidance and visual impact mitigations.

The Authority may undertake these steps independently with local agency input on the final recommendations, collaborate with the local agency to provide input on each step, or develop a unique collaborative process with the local agency, depending on the Authority, PMT and local agency assessment of the most effective approach.

<u>Output</u>

At minimum, the output of an aesthetic design process should identify and quantify, by allowance or quantity, aesthetic and visual mitigations for preliminary cost estimating. The PMT will need to evaluate whether aesthetic design and visual mitigations are within project cost guidelines.

The output can be a table listing mitigation design concepts based on these guidelines with a map of the extent of application, advancing preliminary engineering documentation, or documentation of context specific aesthetic design guidance.

The output of this process will be used as input to the design/build procurement process to ensure that Authority and local agreements on aesthetic design and visual mitigations are implemented.

3.5.4 Environmental Process

<u>Authority</u>

The Authority or the PMT can collaborate with local agencies during the environmental process to solicit input on aesthetic design and visual resource mitigations, consistent with CEQA and NEPA. The Authority will need to evaluate, with consultation with local agencies as appropriate, how to organize and conduct local agency input to the environmental analysis. Content and process should be reasonable, fair and equitable for both the Authority and local agencies. A benefit of incorporating aesthetic design guidance into the EIR/EIS is the opportunity for public comment on the mitigations, furthering environmental process transparency.

Aesthetic design guidance can be incorporated in the environmental documents as part of the project description, 15% preliminary design, and/or as visual mitigation. These guidelines can be incorporated by reference, either in whole or in part, into the EIR/EIS documentation for individual project sections for certification by the Authority and the Federal Railroad Administration.

<u>Local Agencies</u>

Local agencies are responsible to review and provide comment per CEQA and NEPA on visual mitigations consistent with local context, standards and plans. It is the Authority's expectation that by working collaboratively with a local agency on aesthetic design guidance, that the local agency will accept that the process meets CEQA and NEPA requirements for stakeholder engagement with development of visual mitigations.

3.5.5 Design Build Procurement

<u>Authority</u>

The Authority and PMT can initiate an aesthetic design review process with local agencies after the certification of the environmental documents as an input to design/build procurement. This benefits the Authority by fostering greater clarity of the scope of work and reducing risk of

changes to the design/build contract time and scope by working with local agencies to address aesthetic design prior to the design/build contract. The Authority will be responsible for developing aesthetic design guidance that will be consistent with the certified environmental documents.

Local Agencies

Local agencies are responsible for focusing on aesthetic design guidance that implements the certified environmental documents. Local agencies will assist in managing stakeholder engagement to identify aesthetic design guidance that provides a range of directions to the design/builder, rather than defining a specific solution.

3.5.6 Aesthetic Design Review During Design/Build

Authority

After the design/builder contracts with the Authority, the design/builder will be responsible for implementing aesthetic design and visual resource mitigations as specified in the design/build contract. The PMT will be responsible for oversight of the design/build contract to ensure that design work is in conformance with the Authority contract and procurement requirements.

The Authority, PMT or design/builder needs to engage local agencies in aesthetic design review which may include: 1) design of project mitigations, 2) coordination of project design to implement station area planning, use air-rights or design local project interfaces such as rebuilding grade-separations, 3) design details developed for the procurement such as landscape, lighting or public art as mitigation, 4) proposals for innovative solutions not previously considered, and/or 5) proposing changes to the project and/or project mitigations.

The Authority can have the design/builder conduct aesthetic design review with local agencies to view and comment on HST infrastructure concept plans and final design as needed to provide local agencies with assurance that project aesthetics are consistent with local expectations for aesthetic design and visual mitigation. The Authority will work with local agencies to set time frames for aesthetic design review consistent with the design/build contract objectives.

Local Agencies

Local agency responsibilities will vary depending on the type of coordination, input and design review needed based on local participation in the HST project. Baseline responsibilities include: 1) timely review and input to design/build documents per the design/build contract schedule, 2) respecting Authority project budget and funding, 3) reasonable feedback that contributes to feasible solutions.

3.5.7 Capital Costs and Maintenance

Capital Costs

In general, the Authority pays for the capital costs of the project, environmental mitigations, and right-of-way acquisition costs. Local agencies are to pay fair share capital costs for improvements not included in the scope of the HST project or project mitigations as presented in Table 1.

Maintenance

In general, the responsibility for the facility maintenance and the cost of maintenance belongs to the party who owns the facility, as summarized in Table 1. In cases where the Authority or local agency can provide maintenance on behalf of the other, resulting in more efficient use of resources, the Authority and local agencies can enter a maintenance agreement.

Table 1: Capital and Maintenance Responsibilities: Non-Station Structures

	AUTHORITY		**LOCAL JURISDICTION**	
Category	***Capital Cost***	***Ownership and Maintenance***	***Capital Cost***	***Ownership and Maintenance***
Structures	100% All structures comprising HST facilities, including HST aerial structures, HST bridges and overpasses, trenches, sound walls, retaining walls and barriers.	100%	0%	0%
Grade separations and roadways	100% Project grade separations, retaining walls, berms, pavement, pavement markings, bike lanes, curbs, sidewalks and guardrails.	100% Grade separation substructure and super structures, railway approaches and infrastructure.	0% Or fair share proportion of expansion of existing roadway capacity.	0% Roadways, roadway approaches and grade separation berms or retaining walls including pedestrian and bicycle facilities
Landscape	100% All project landscaping, irrigation and hardscape	100% and up to first three years until landscaping is established for landscape located outside HST right-of-way	0%	100% After landscape established outside HST right-of-way, including irrigation, planting and hardscape
Lighting	100% All functional and safety lighting for Authority facilities	100% All functional and safety lighting for Authority facilities within HST right-of-way	0%	100% City lighting in city right-of-way

	AUTHORITY		LOCAL JURISDICTION	
Category	***Capital Cost***	***Ownership and Maintenance***	***Capital Cost***	***Ownership and Maintenance***
Public Art[2]	100% For public art as visual impact mitigation per budget to be established by Authority	0%	0% or fair share proportion for public art costs in addition to what is required for mitigation	100% For all public art, including art attached to HST infrastructure
Facilities using air rights[3]	100% All facilities owned and operated by Authority.	100% All facilities owned and operated by Authority.	100% All facilities developed publicly or privately per air rights agreement with Authority.	100% All facilities developed publicly or privately per air rights agreement with Authority.
Utilities	100% Authority facilities.	100% Authority owned facilities.	0% or fair share proportion of any expansion of existing capacity.	100% of city owned facilities.
Signage	100% Authority signs	100% Authority signs except signage for others located in the HST right-of-way maintained by others through encroachment agreements.	0% of city signage.	100% of city signage per encroachment agreement.

[2] The Authority is developing a policy regarding Public Art to be consistent with existing state and federal policies. The Authority's capital cost for public art for HST stations is to pay for cost to integrate public art into HST station design, with cost for the artwork itself and maintenance to be funded in fair share proportion by the City and others as part of a value capture program for station area development. The Authority's capital cost for public art for non-station structures is to cover the cost of public art as visual mitigation, with any additional public art costs to be paid for by the local agency. The Authority's policies for public art will address funding public art as mitigation.

[3] The Authority is developing a policy regarding use of air space above and below HST facilities, including developing restrictions related to HST operations, access, maintenance and security. The Authority supports locating active uses under aerial structures in urban areas to create safe, secure environments and reduce the potential for graffiti.